

*Top Quark Physics
and
Searches for New Phenomena
at the
Tevatron*

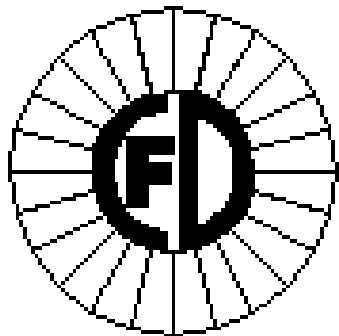
Presented at
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Laboratori Nazionali di Frascati - INFN Frascati - Italy

Raymond E. Hall
for The DØ and CDF Collaborations

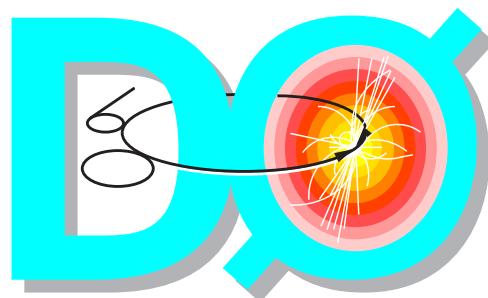
University of California, Irvine
September 8, 1997

Outline

reporting on results from:



and



- Top Physics
 - ◆ Top Quark Mass
 - ◆ Top Quark Production Cross Section
 - ◆ Other Top Measurements
- Searches for New Phenomena
 - ◆ Mass Limits on LQ_1
 - ◆ Missing Et + Jets in SUGRA
 - ◆ Summaries of Other Search Analyses
- Conclusions

Top quark production and decay

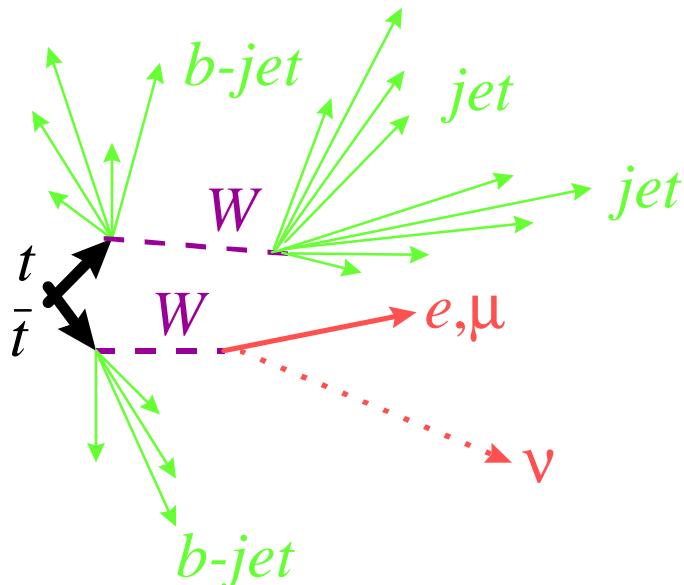
At Tevatron: $qq \rightarrow t\bar{t}$ (90%)

$gg \rightarrow t\bar{t}$ (10%)

$t \rightarrow Wb$ $W \rightarrow \ell\nu$ or $q\bar{q}$

Channels classified on basis of W decay:

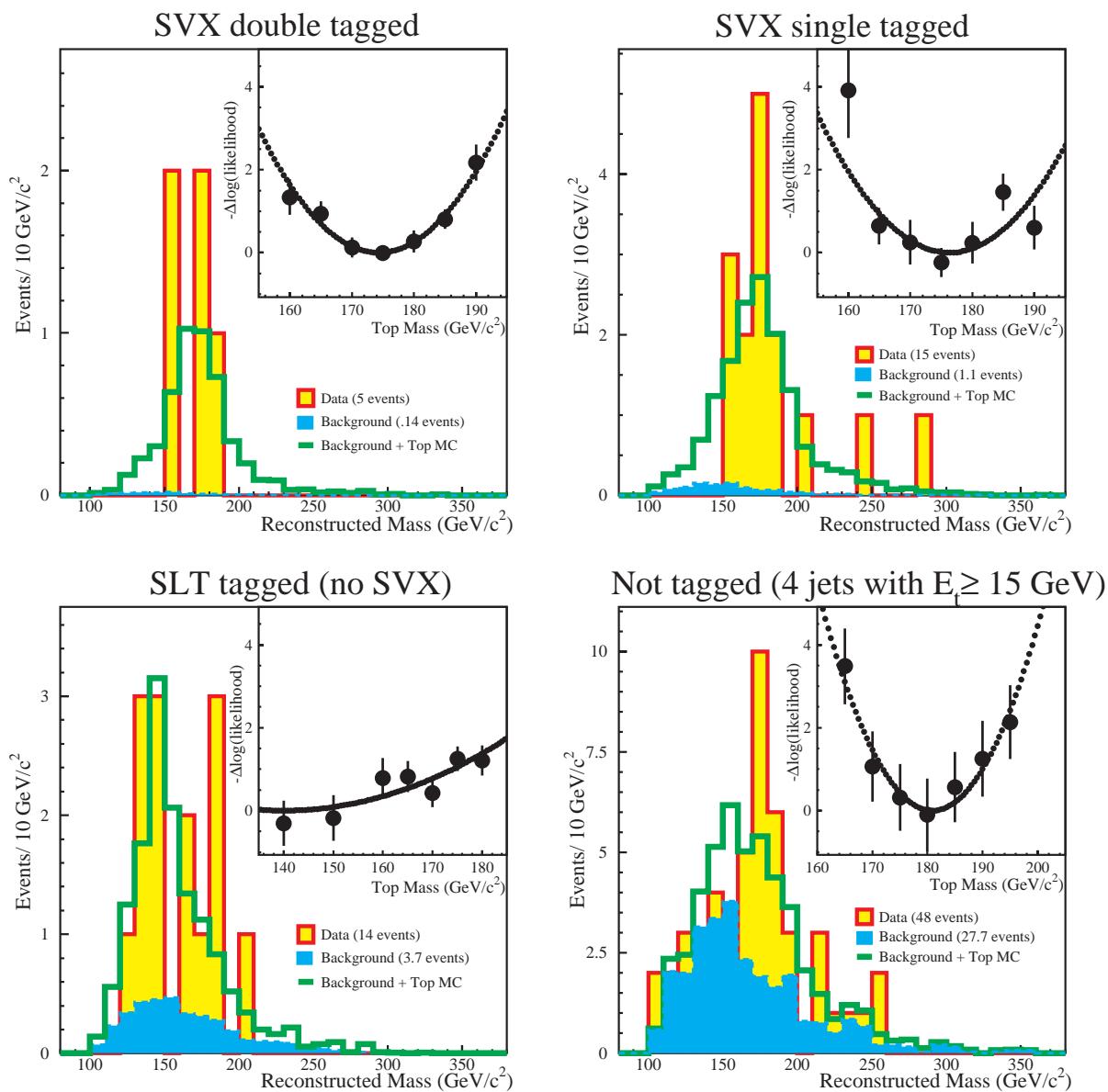
Lepton + Jets Top Mass Measurement



- Event selection.
 - ♦ One high p_T lepton (e or μ).
 - ♦ Missing E_T .
 - ♦ Four jets.
 - ♦ b -tag (CDF,D \emptyset) or event shape (D \emptyset).
- Mass Estimator.
 - ♦ 2C constrained fit to $t\bar{t} \rightarrow \ell + \text{jets}$ hypothesis.
- Likelihood fit.
 - ♦ Fit data to expectation from signal and background. Maximize likelihood with respect to top quark mass.

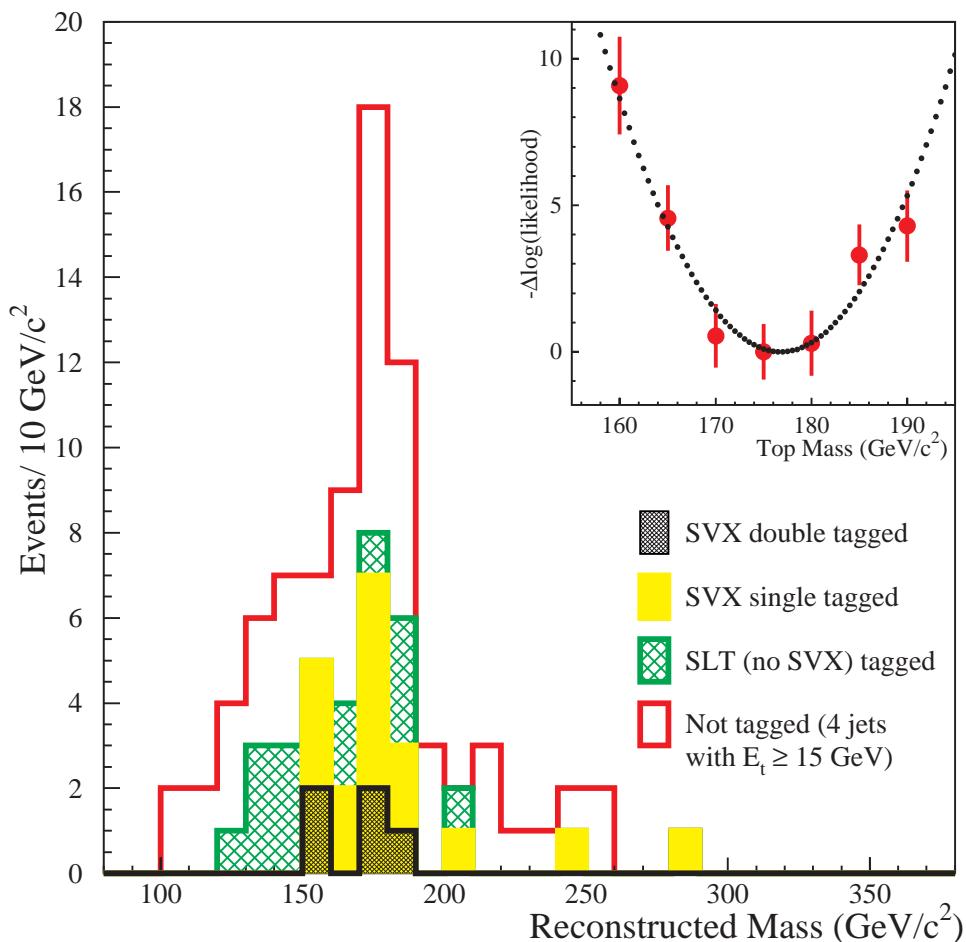
CDF Lepton + Jets Top Mass

- Calculate likelihoods for four independent subsamples.



CDF Lepton + Jets Top Mass

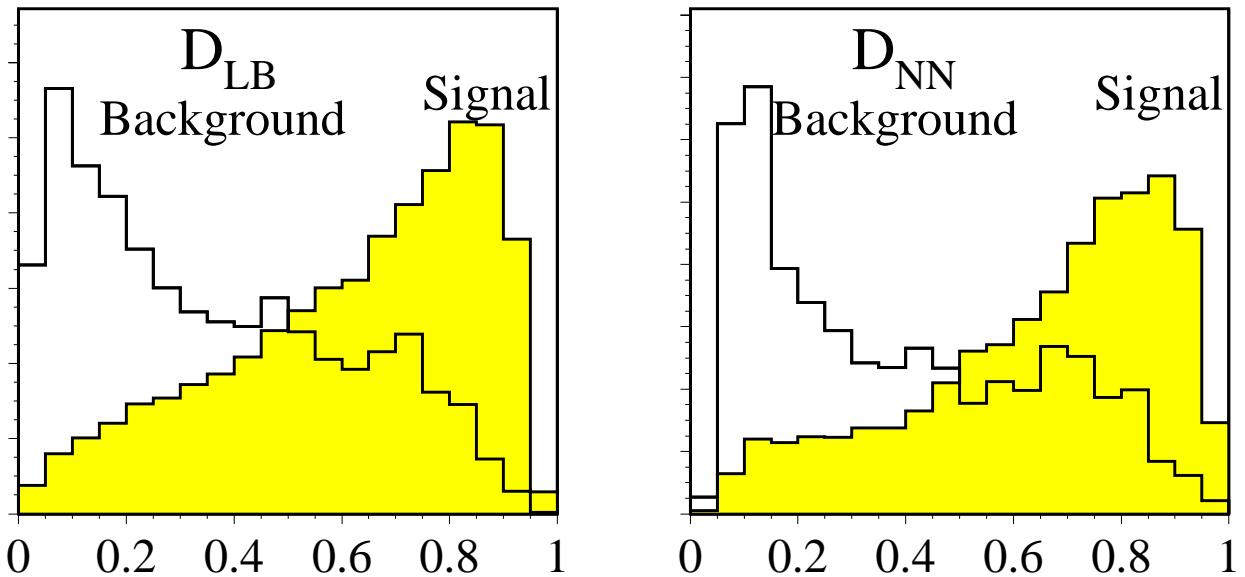
- Final likelihood is product of subsample likelihoods.



$$m_t = 176.8 \pm 4.4 \text{ (stat.)} \pm 4.8 \text{ (syst.)} \text{ GeV}/c^2$$

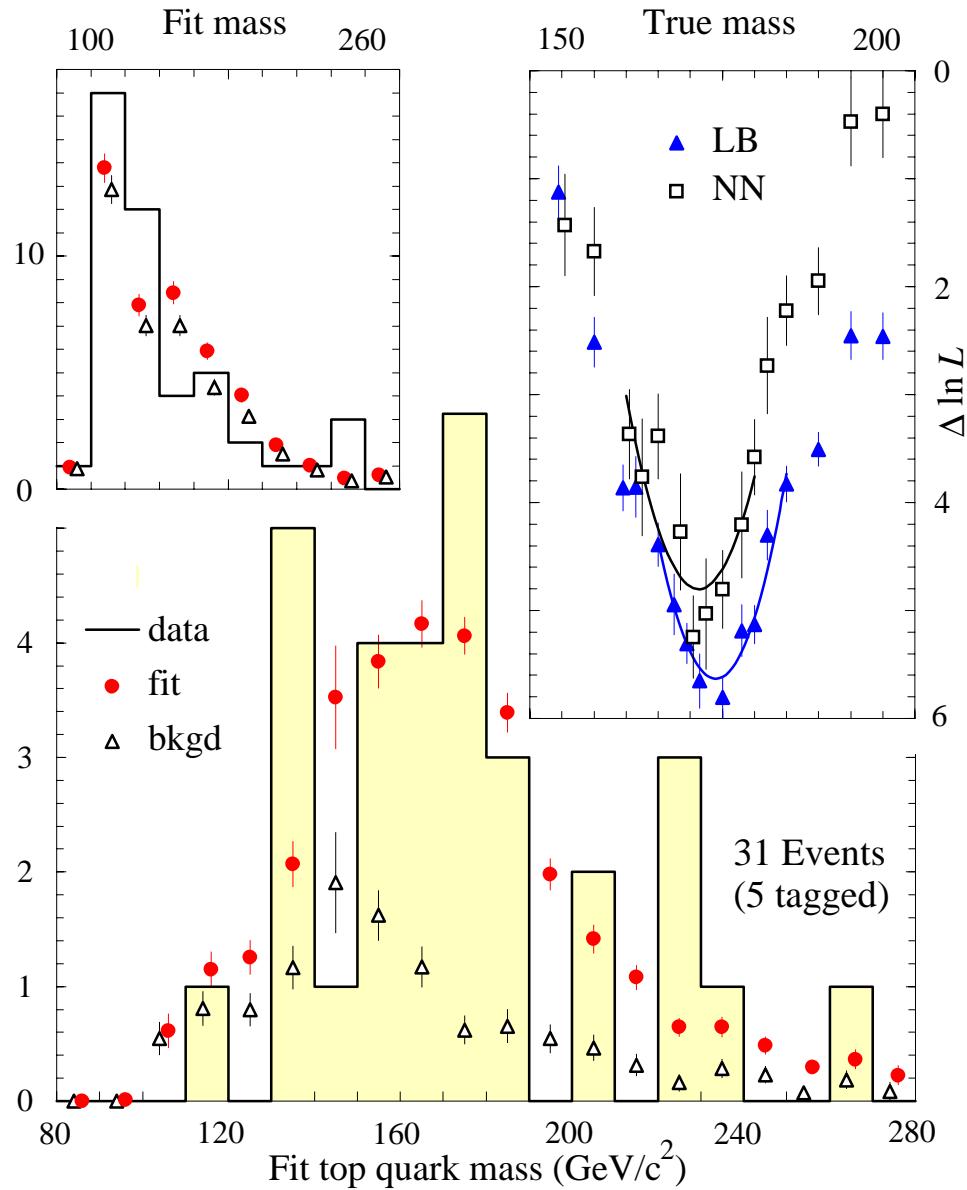
$D\emptyset$ Lepton + Jets Top Mass

- Event shape analysis based on four mass-insensitive variables.
- Two independent analyses based on two multivariate discriminants.
 - ♦ “Low bias” discriminant (D_{LB}).
 - ♦ Neural Network discriminant (D_{NN}).



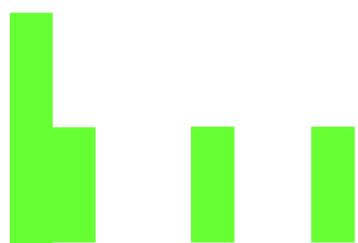
- Two dimensional likelihood fit (D vs. m_t).

$D\bar{\theta}$ Lepton + Jets Top Mass



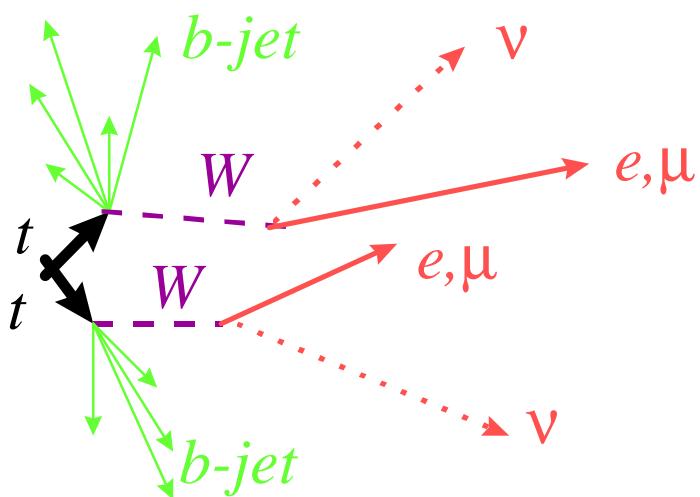
$$m_t = 173.3 \pm 5.6 \text{ (stat.)} \pm 6.2 \text{ (syst.)} \text{ GeV}/c^2$$

PRL 79, 1197 (1997)



b-tag events

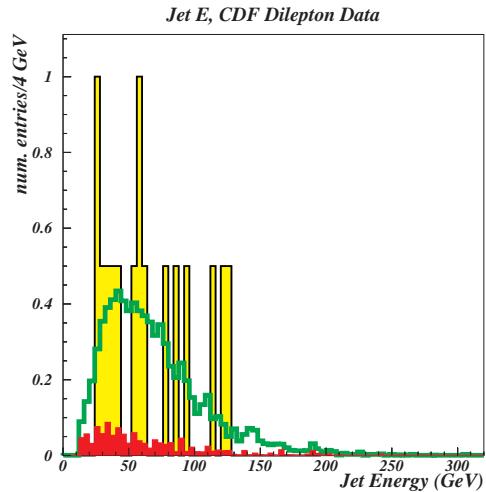
Dilepton Top Mass Measurement



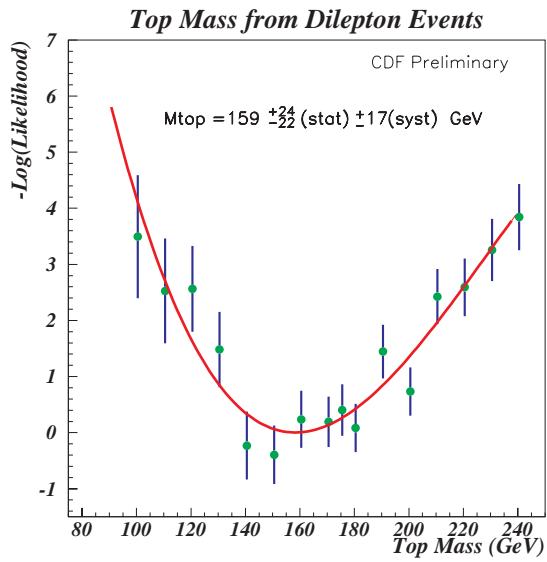
- Event selection.
 - ◆ Two high p_T leptons (e or μ).
 - ◆ Missing E_T .
 - ◆ Two jets.
 - ◆ $H_T = \sum E_T(\text{jets})$.
- Mass Estimator (no reconstructed mass).
 - ◆ CDF.
 - ▷ Jet energy (CDF).
 - ▷ $m_{\ell b}$ (CDF).
 - ◆ DØ.
 - ▷ Matrix element weight.
 - ▷ Neutrino weight.

CDF Dilepton Top Mass

Jet energy distribution
 (8 events, 16 jets).



Likelihood fit.

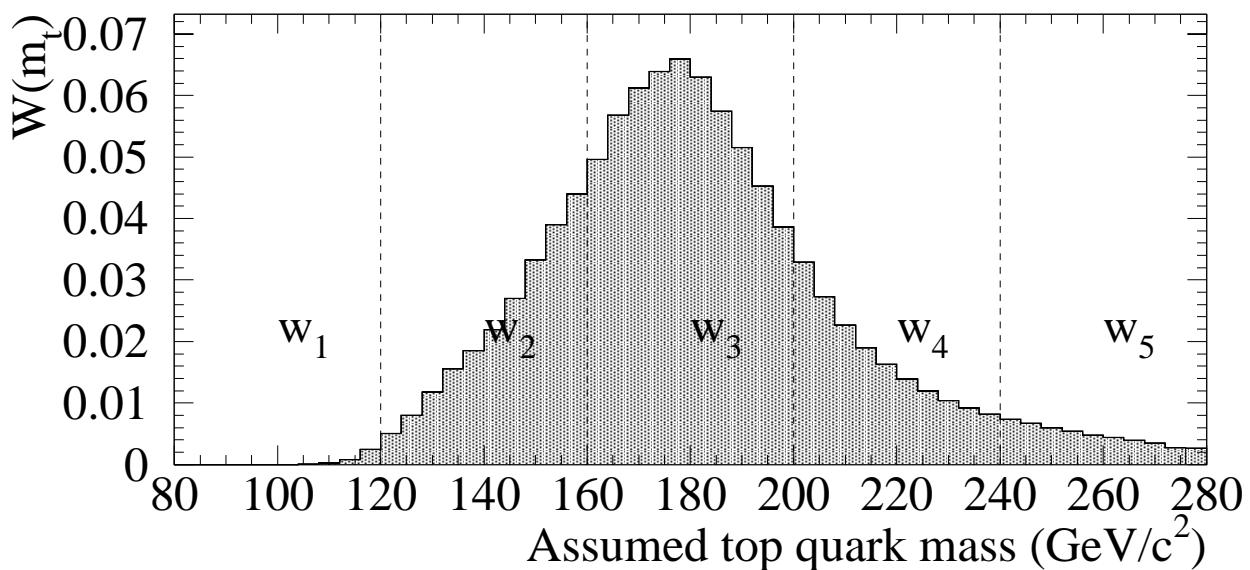


$$m_t = 159^{+24}_{-22} \text{ (stat.)} \pm 17 \text{ (syst.) GeV/c}^2 \text{ (Jet } E_T)$$

$$m_t = 162 \pm 21 \text{ (stat.)} \pm 7 \text{ (syst.) GeV/c}^2 \text{ (} m_{\ell b} \text{)}$$

DØ Dilepton Top Mass

- Weight curve method.
 - ◆ Assume a top quark mass & reconstruct event.
 - ◆ Calculate weight curve as a function of m_t .*



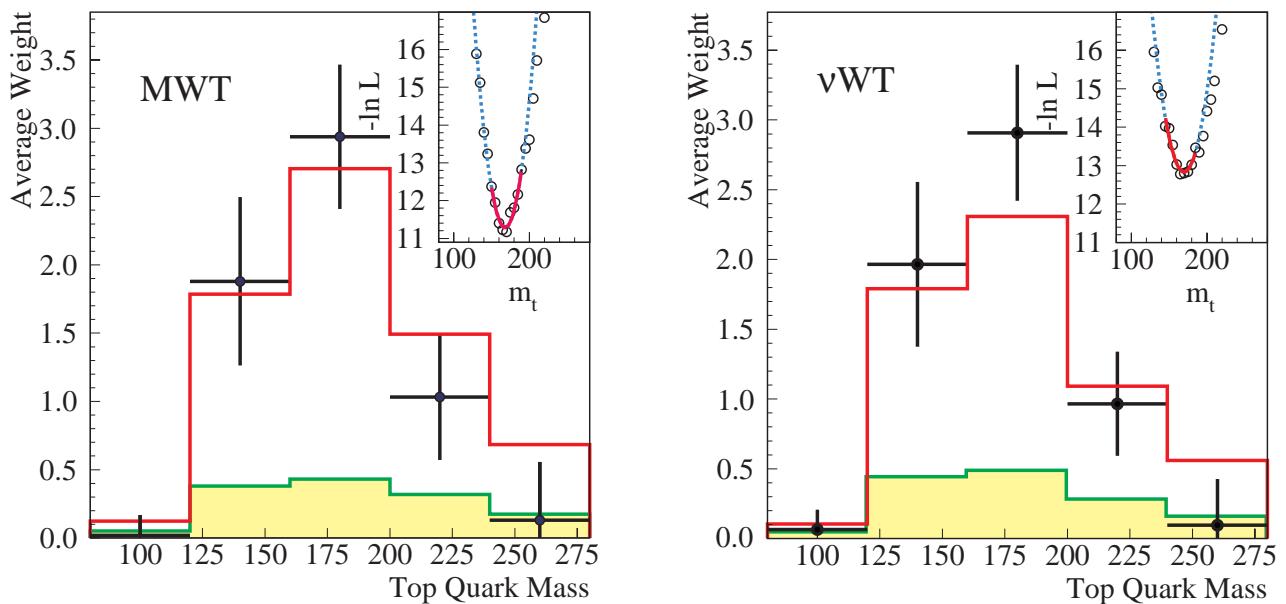
- Extract four values for each dilepton event.

* K. Kondo, J. Phys. Soc. Jpn. 57, 4126 (1988) and 60, 836 (1991).

R.H. Dalitz and G.R. Goldstein, Phys. Rev. D 51, 4763 (1995).

DØ Dilepton Top Mass

- Six events.
- Four dimensional likelihood fit using four dimensional top and background templates.

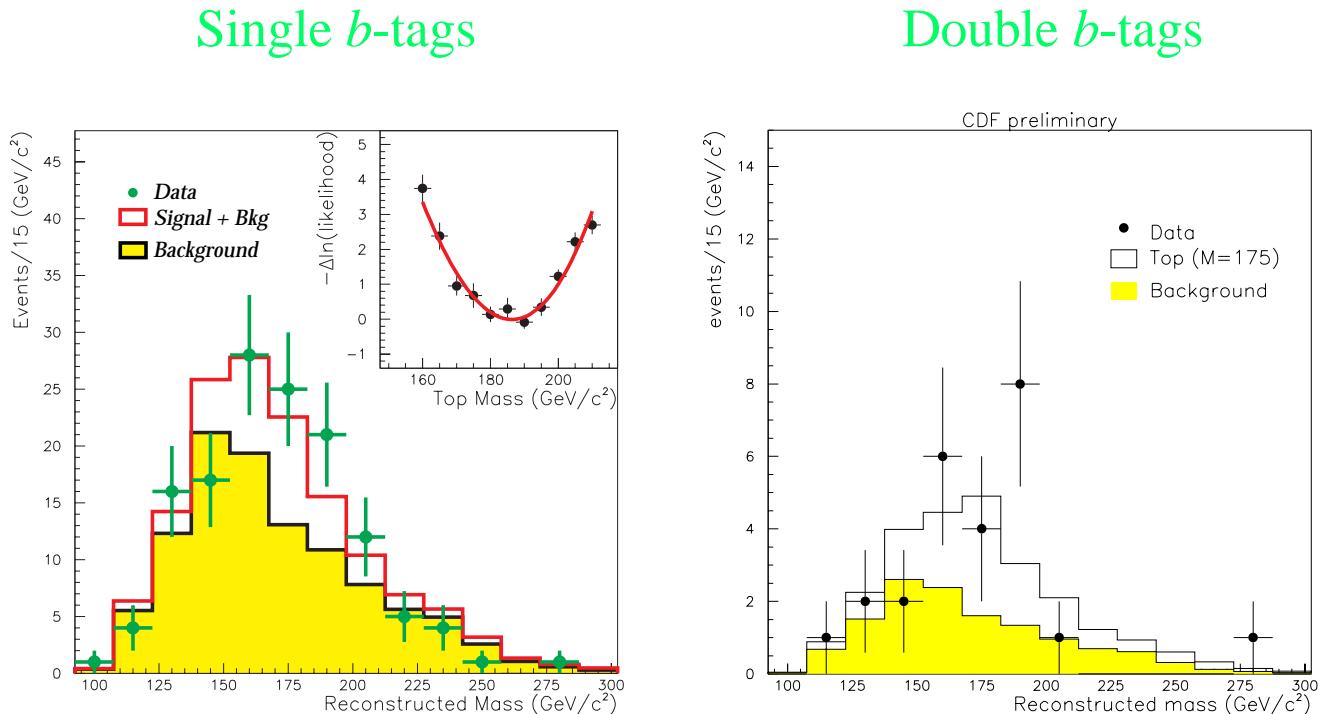


$$m_t = 168.4 \pm 12.3 \text{ (stat.)} \pm 3.7 \text{ (syst.)} \text{ GeV}/c^2$$

Submitted to PRL, Fermilab-Pub-97/172-E, hep-ex/9706014.

CDF All Jets Top Mass

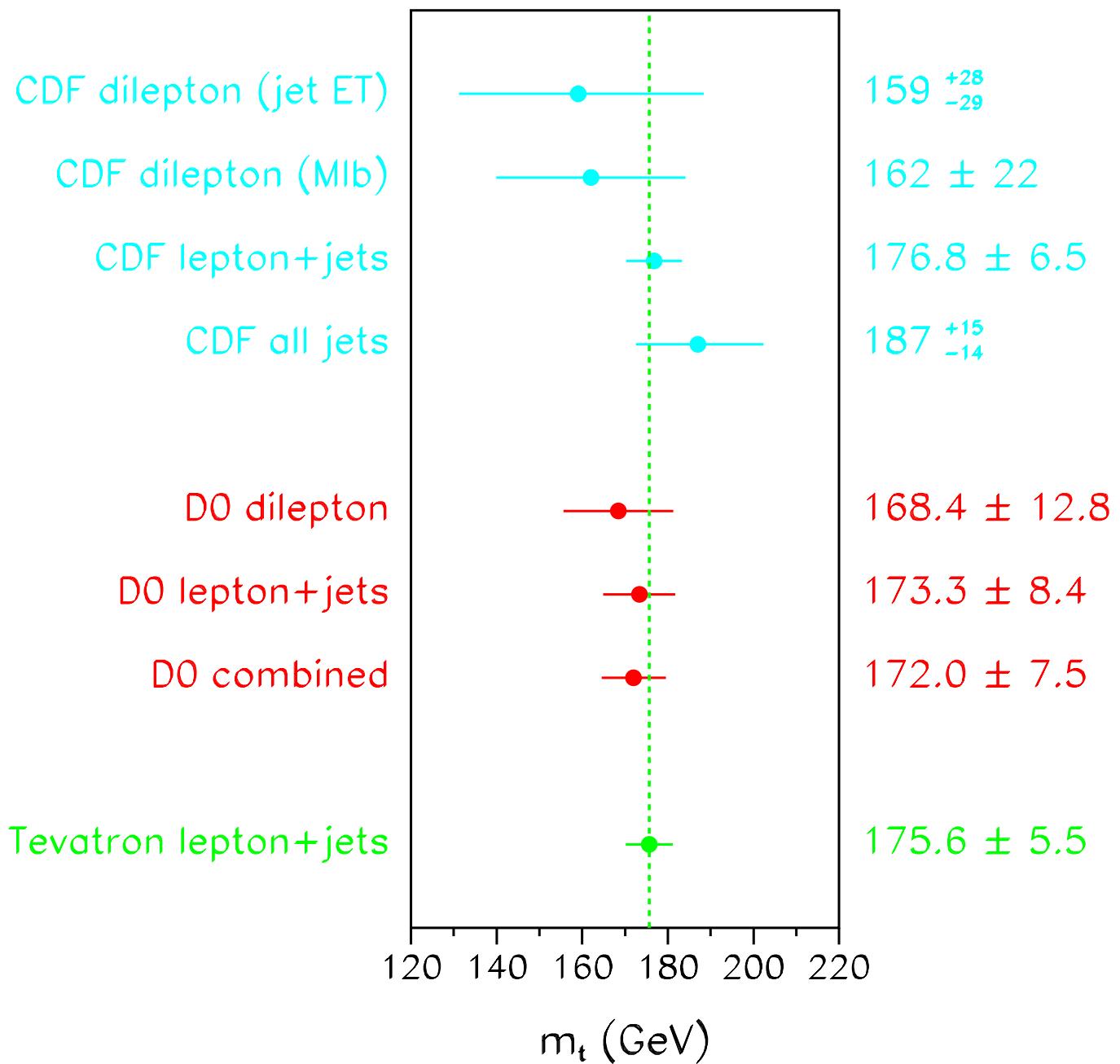
- Event selection.
 - ◆ Six jets.
 - ◆ b -tag.
 - ◆ Event shape (aplanarity, $\Sigma E_T/m(\text{jets})$).
 - ◆ 136 events, est. background 108 ± 9 .
- Mass Estimator.
 - ◆ 3C constrained fit to $t\bar{t} \rightarrow \text{all jets}$ hypothesis.



$$m_t = 187 \pm 8 \text{ (stat.)} \pm 13 \text{ (syst.)} \text{ GeV}/c^2$$

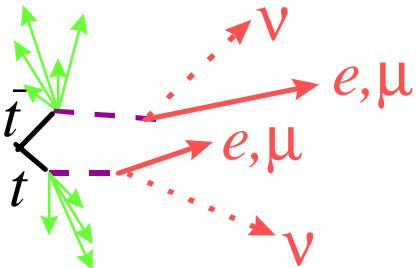
Submitted to PRL, Fermilab-Pub-97/075-E.

Top Quark Mass Summary



Top Quark Cross Section

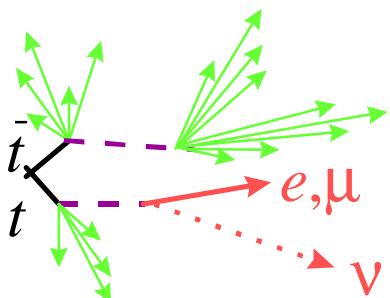
- Dilepton (ee , $e\mu$, $\mu\mu$ + 2 jets + missing E_T).



	Data	Background
CDF	9	2.1 ± 0.4
DØ	5	1.4 ± 0.4

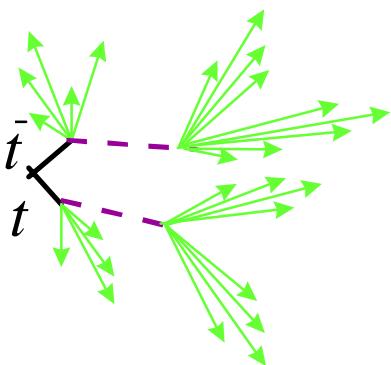
- Lepton + jets (e , μ + 3 or 4 jets + missing E_T).

- ▷ Vertex or soft lepton b -tag.
- ▷ Shape, aplanarity and $H_T = \sum E_T(\text{jets})$ (DØ).



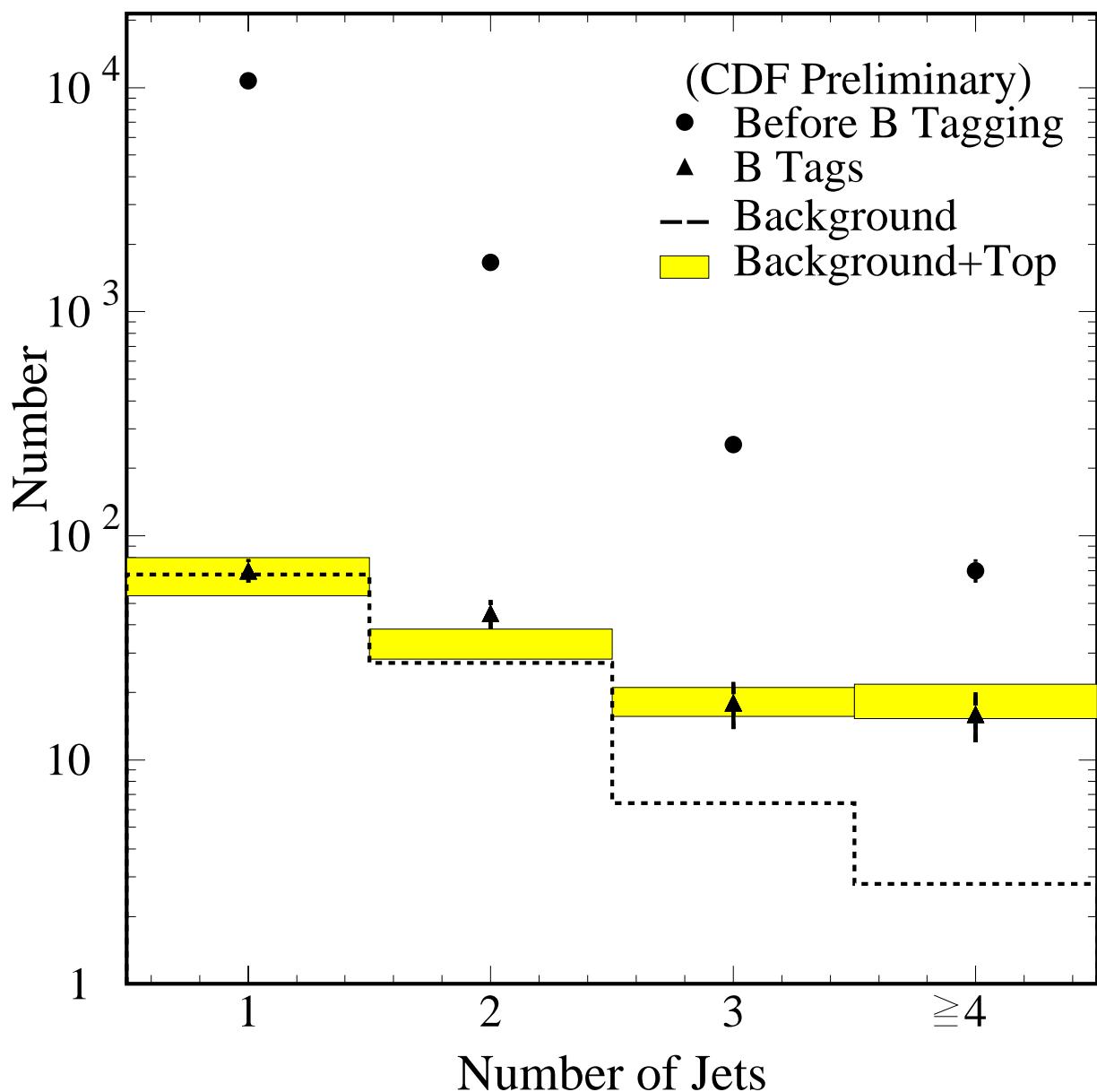
	Data	Background
CDF SVX	34	8.0 ± 1.4
CDF SLT	40	24.3 ± 3.5
DØ μ -tag	11	2.4 ± 0.5
DØ shape	19	8.7 ± 1.7

- All jets (5 or 6 jets, 1 or 2 b -tags, event shape).



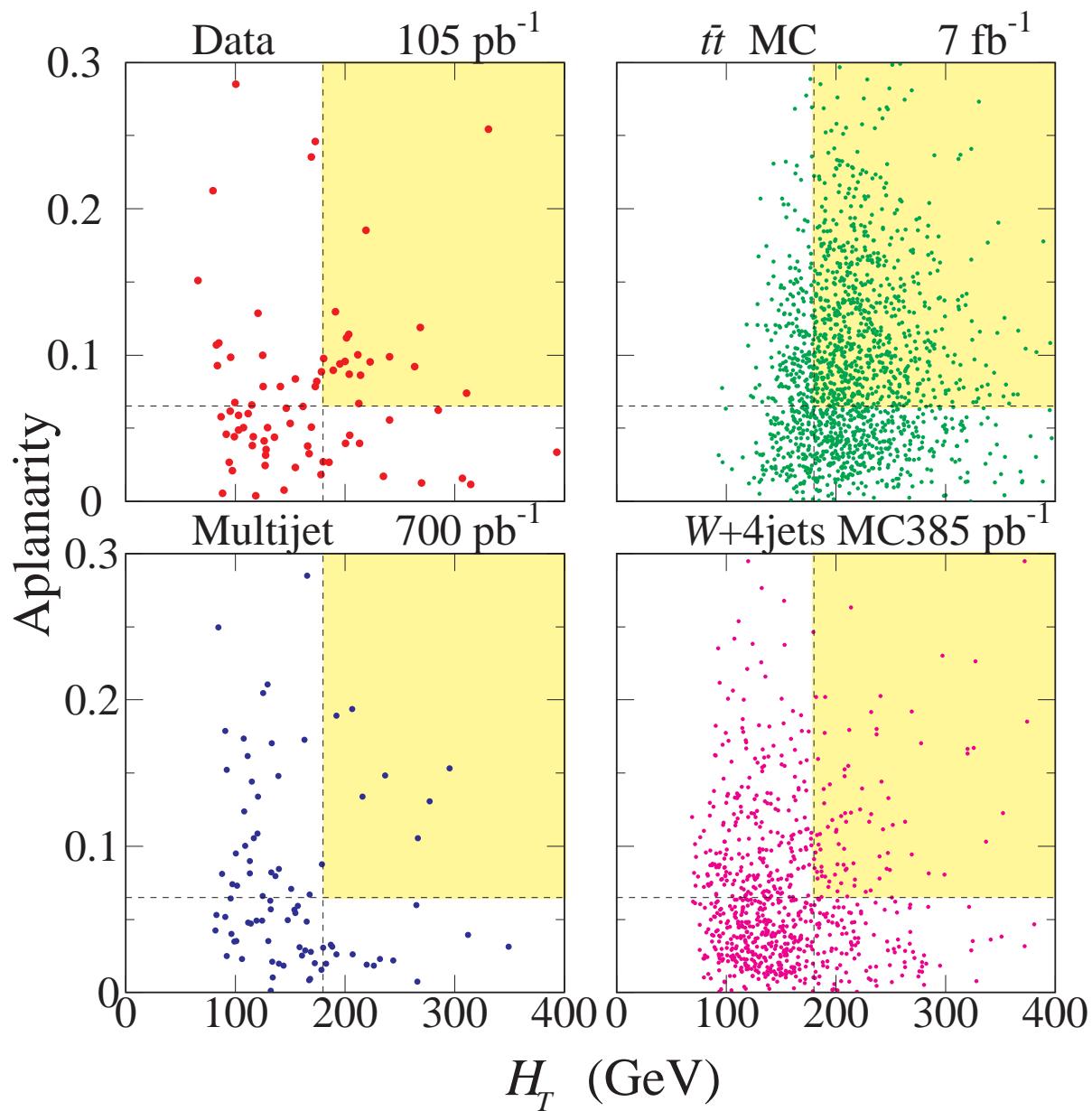
	Data	Background
CDF 1b	187	142 ± 12
CDF 2b	157	120 ± 18
DØ 1b	44	25.3 ± 3.1

CDF Lepton + Jets *SVX b-Tag Analysis*



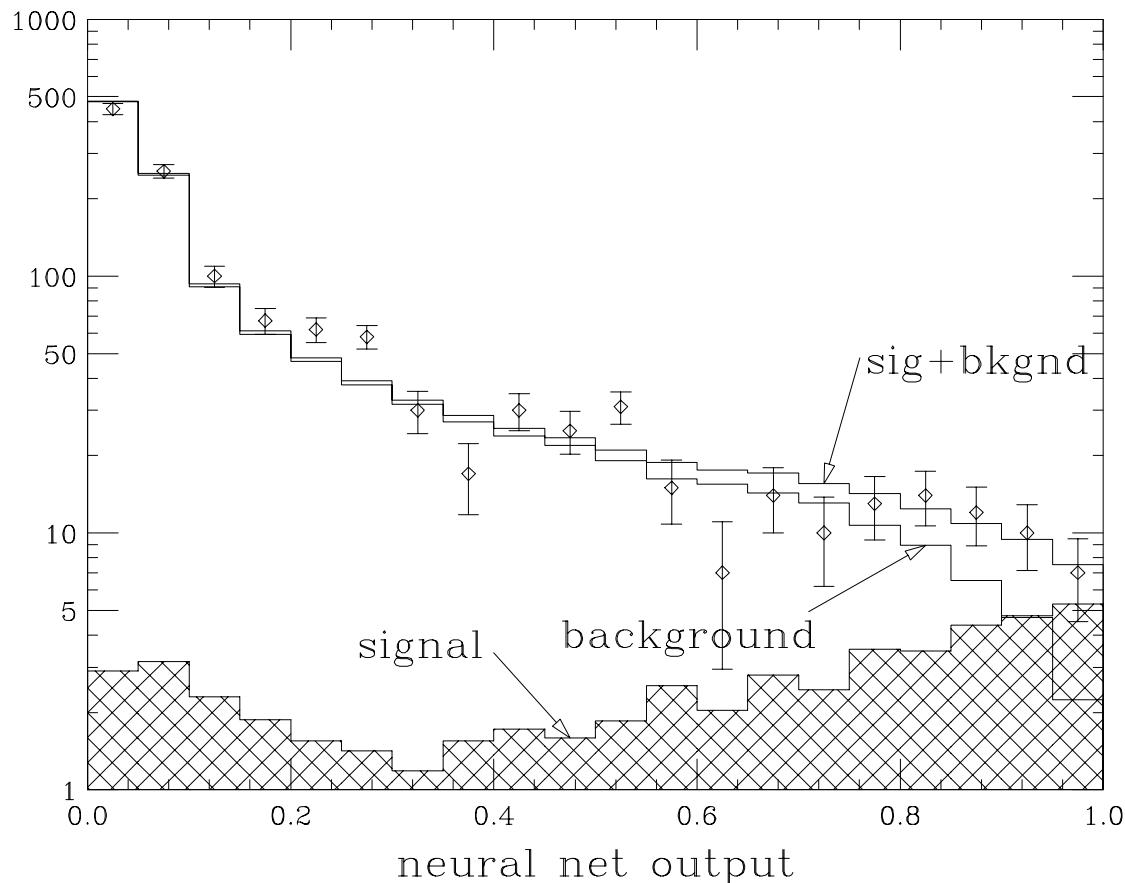
DØ Lepton + Jets

Event Shape Analysis



DØ All Jets Analysis

- Basic selection: 6 jets + soft μ b -tag.
 - ◆ Additional selection using 11 variable neural network including:
 - ▷ $H_T = \sum E_T(\text{jets})$ and other energy variables..
 - ▷ Event shape (aplanarity, sphericity, centrality, etc.).
 - ▷ Jet width (quark/gluon discriminator).



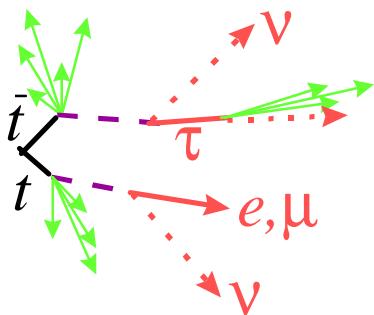
$$\sigma_{tt} = 7.9 \pm 3.1 \text{ (stat.)} \pm 1.7 \text{ (syst.) pb}$$

Top Quark Cross Section

(cont.)

- **Other Signatures.**

- ◆ $\ell\tau$ (CDF) ($e, \mu +$ hadronic $\tau + 2$ jets + missing E_T).
- ◆ $e\nu$ (DØ) ($e + 2$ jets + missing E_T).
 - ▷ Very high missing E_T ($E_T > 50$ GeV).
 - ▷ High transverse mass ($M_T > 115$ GeV).



	Data	Background
CDF $\ell\tau$	4	2.0 ± 0.4
DØ $e\nu$	4	1.2 ± 0.4

- **Publications**

- DØ dilepton, lepton+jets, $e\nu$, PRL **79**, 1203 (1997)
- CDF all jets, submitted to PRL, Fermilab-Pub-97/075-E.
- CDF $\ell\tau$, submitted to PRL, Fermilab-Pub-97/096-E.

Summary of CDF Results

$\int L dt \approx 110 \text{ pb}^{-1}$

$m_t = 175 \text{ GeV}/c^2$

Channel	$\varepsilon \times \text{BR}(\%)$	Data	Bckgd	$\sigma_{t\bar{t}} (\text{pb})$
Dilepton	0.74 ± 0.08	9	2.1 ± 0.4	$8.5 +4.4 -3.4$
$\ell+j$ (SVX)	3.5 ± 0.7	34	8.0 ± 1.4	$6.8 +2.3 -1.8$
$\ell+j$ (SLT)	1.7 ± 0.3	40	24.3 ± 3.5	$8.0 +4.4 -3.6$
Combined	—	83	33.4	$7.5 +1.9 -1.6$
Had¹	4.4 ± 0.9	187	142 ± 12	$9.6 +4.4 -3.6$
Had²	3.0 ± 0.9	157	120 ± 18	$11.5 +7.7 -7.0$
Had¹⁺²	—	—	—	$10.1 +4.5 -3.6$
τ-dilepton	0.12 ± 0.014	4	2.0 ± 0.4	$15.6 +19 -13^*$

¹: single tag + kinematics; ²: double tag

*: statistical uncertainty only

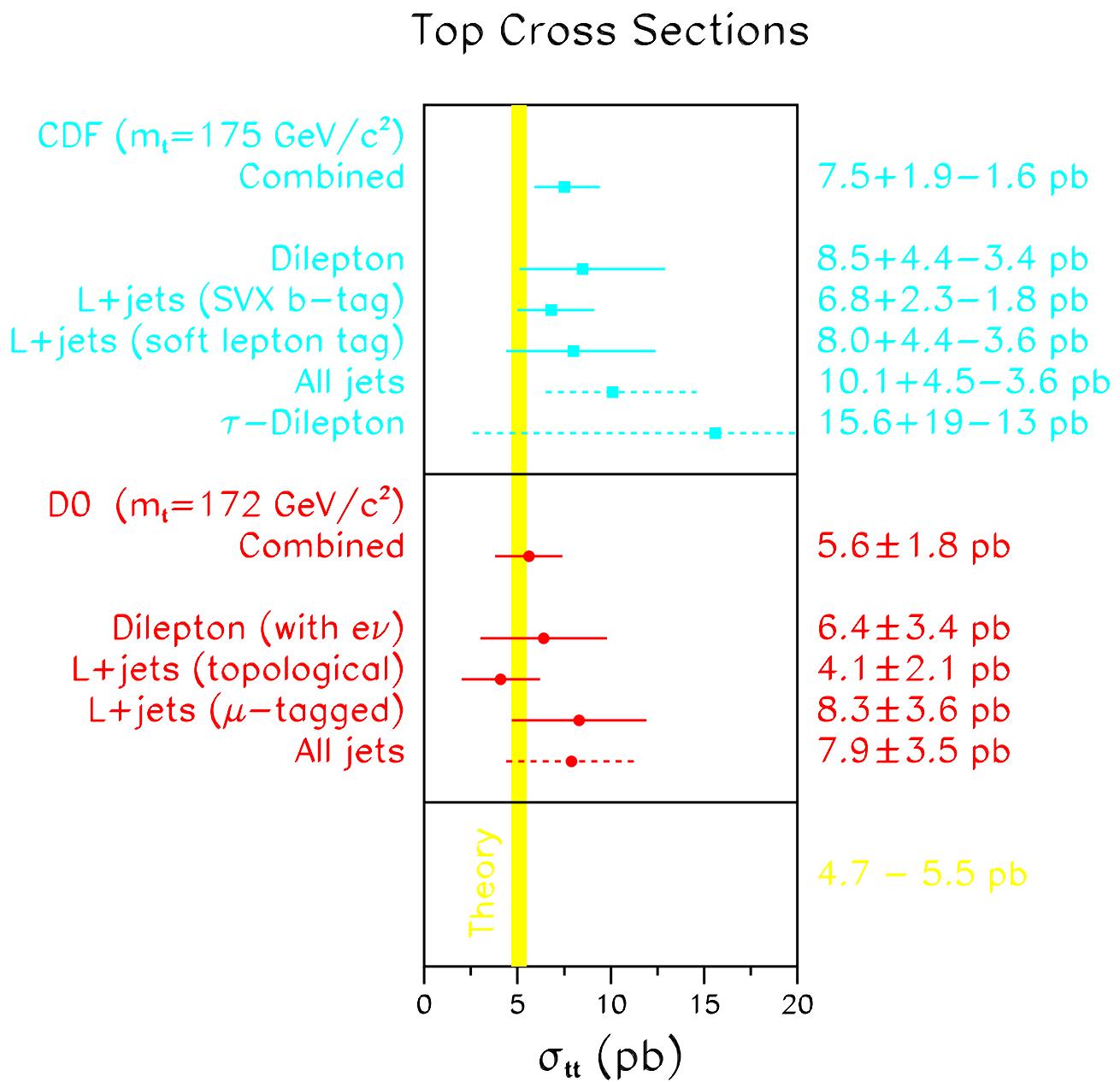
Summary of DØ Results

$\int L dt \approx 125 \text{ pb}^{-1}$

$m_t = 172 \text{ GeV}/c^2$

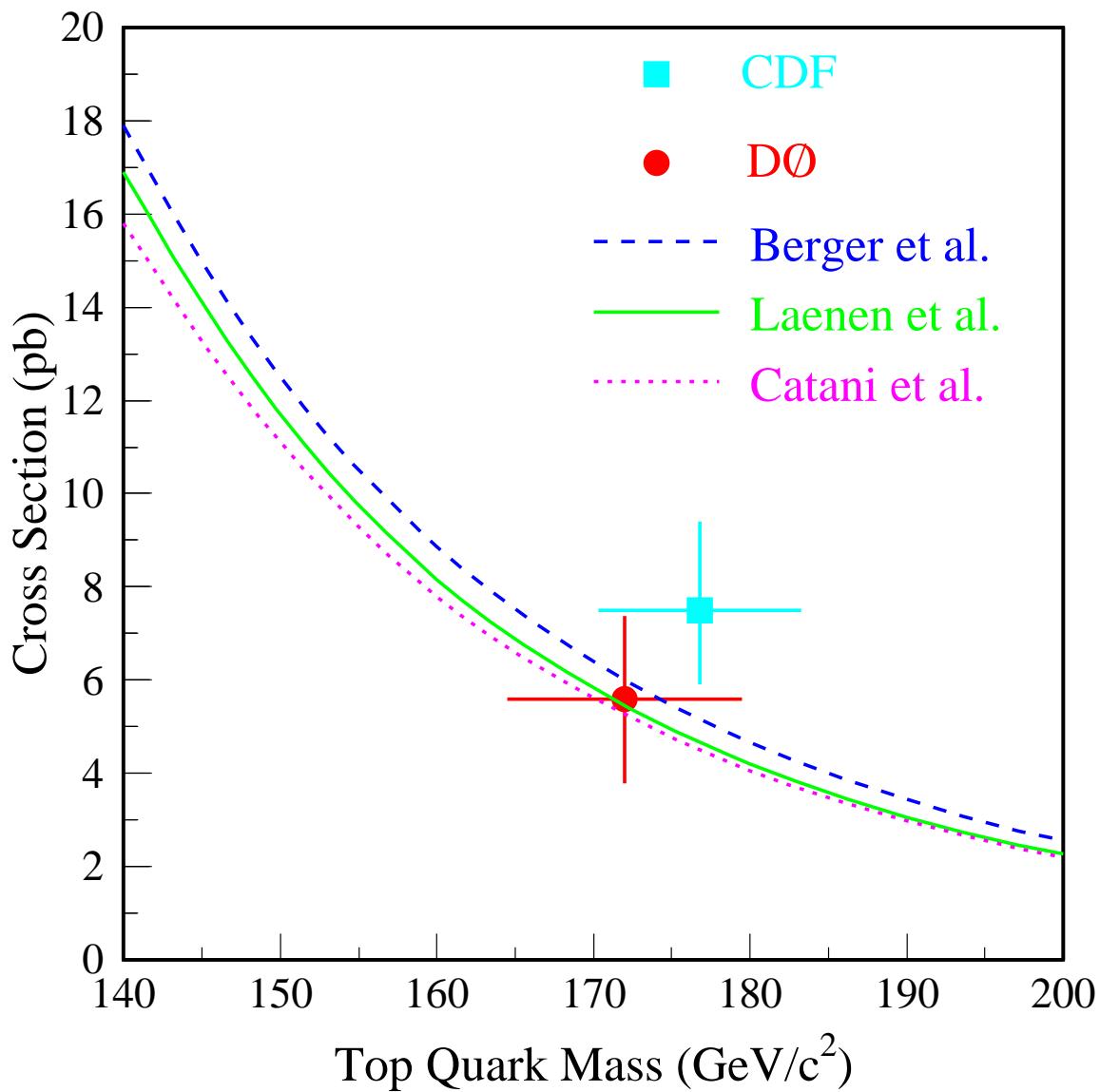
Channel	$\varepsilon \times \text{BR}(\%)$	Data	Bckgd	$\sigma_{t\bar{t}} (\text{pb})$
$\ell\ell$ (with ev)	0.91 ± 0.17	9	2.6 ± 0.6	6.4 ± 3.4
$\ell+j$ (topol.)	2.17 ± 0.46	19	8.7 ± 1.7	4.1 ± 2.1
$\ell+\text{jets}/\mu$	0.96 ± 0.15	11	2.4 ± 0.5	8.3 ± 3.6
Combined	4.14 ± 0.69	39	13.7 ± 2.2	5.6 ± 1.8
All jets	1.8 ± 0.4	44	25.3 ± 3.1	7.9 ± 3.5

Top Cross Section Results



Combined cross sections do not include dashed results

Top Quark Cross Section vs. Mass



CDF $\sigma_{tt} = 7.5^{+1.9}_{-1.6}$ pb (@ $m_t = 175.0$ GeV/c²)

DØ $\sigma_{tt} = 5.6 \pm 1.8$ pb (@ $m_t = 172.0$ GeV/c²)

Other CDF Top Quark Results

- Upper limit on top decaying to charged Higgs.

$$m_{H^\pm} > 147 \text{ GeV}/c^2 (\sigma_{tt} = 5.0 \text{ pb}, \tan\beta = \infty)$$

$$m_{H^\pm} > 158 \text{ GeV}/c^2 (\sigma_{tt} = 7.5 \text{ pb}, \tan\beta = \infty)$$

Submitted to PRL Fermilab-Pub-97/058-E.

- Upper limit on the FCNC decays of the top quark.

$$\text{BR}(t \rightarrow q\gamma) < 2.9\% \text{ @ 95% CL}$$

$$\text{BR}(t \rightarrow qZ) < 44\% \text{ @ 95% CL}$$

- Measurement of $R_b = \Gamma(t \rightarrow Wb)/\Gamma(t \rightarrow Wq)$
 $= |V_{tb}|^2$.

$$R_b = 1.23_{-0.31}$$

$$+0.37$$

Future Top Physics at the Tevatron

- Tevatron run 2 begins late 1999.
- Expect $\int L dt = 2 \text{ fb}^{-1}$ per experiment (20 times current data of 100 pb^{-1}).
- $\sqrt{s} = 2.0 \text{ TeV}$ (35% increase in $t\bar{t}$ cross section relative to current $\sqrt{s} = 1.8 \text{ TeV}$).
- Expected top event yield about 40 times current sample:

	Events per experiment	$S:B$
Dilepton	200	5:1
$\ell + 3 \text{ jets} + b\text{-tag}$	1400	3:1
$\ell + 4 \text{ jets} + 2b\text{-tags}$	600	12:1
Single top	180	1:2

Conclusions

- Both Tevatron experiments have measured the top quark mass.
 $m_t = 176.8 \pm 6.5 \text{ GeV}$ CDF
 $m_t = 172.0 \pm 7.5 \text{ GeV}$ DØ
 $m_t = 175.6 \pm 5.5 \text{ GeV}$ Tevatron
- Both Tevatron experiments have measured the top quark production cross section.
 $\sigma_{tt} = 7.5^{+1.9}_{-1.6} \text{ pb}$ @ $m_t = 175 \text{ GeV}$ CDF
 $\sigma_{tt} = 5.6 \pm 1.8 \text{ pb}$ @ $m_t = 172 \text{ GeV}$ DØ
- Expect 40 times current top quark event samples in run 2 (begins late 1999).

Different Techniques

- Different signatures are better suited to different values of β
 - ◆ $\beta=1 \Leftrightarrow eejj$ (best for explaining HERA events)
 - ◆ $\beta=0.5 \Leftrightarrow evjj$
 - ◆ $\beta=0.0 \Leftrightarrow vvjj$
- CDF uses kinematic selection, and then stresses mass analysis
 - ◆ if a signal were observed, this would provide measurement of the particle mass
- DØ uses loose initial selection, and formal optimization of kinematic selection
 - ◆ “Random Grid Search” (RGSearch)^[1] and neural net analyses give same result

[1] N. Amos *et al.*, in **Proceedings of the International Conference on Computing in High Energy Physics '95**, pp. 215—219.

LQ_1 Search: CDF $eejj$ channel

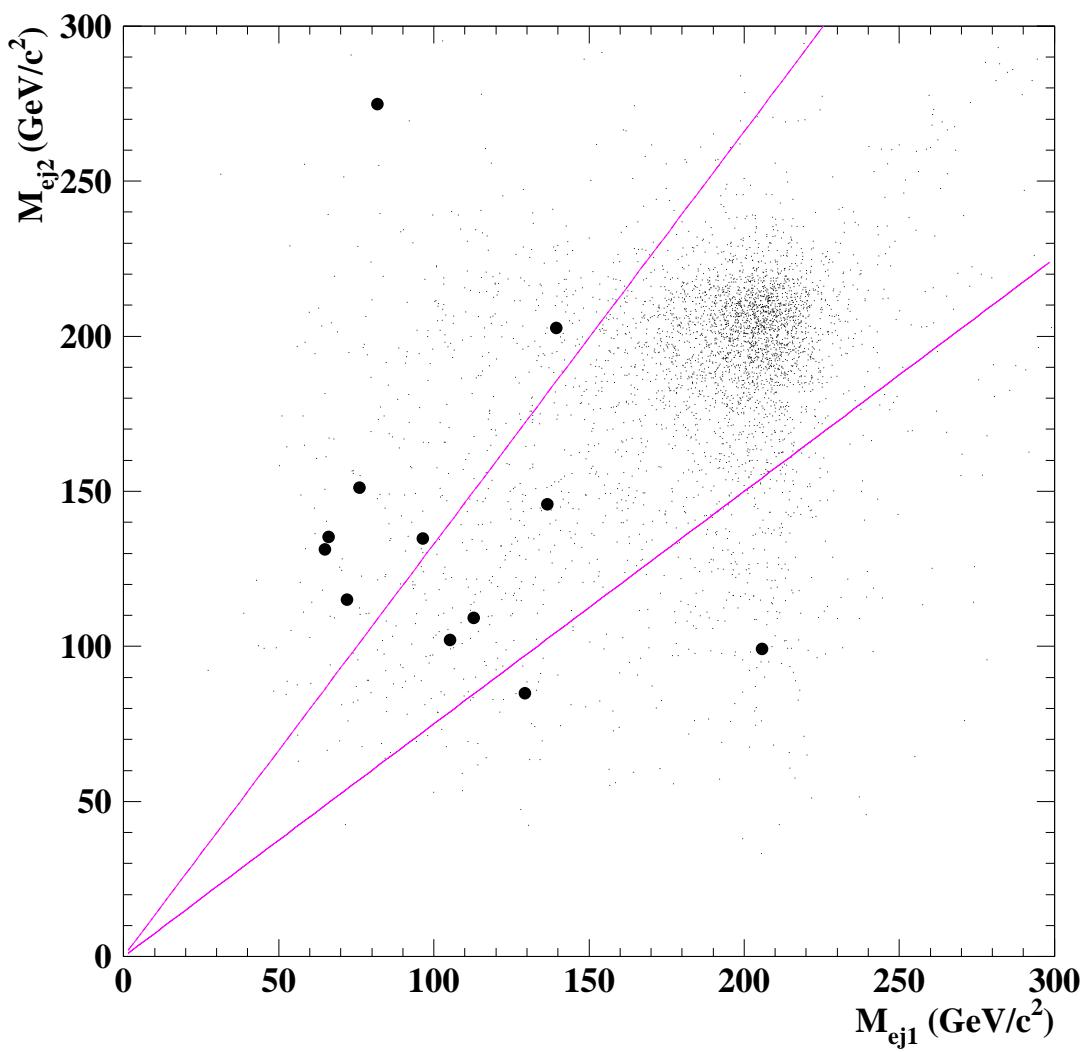
- Integrated luminosity: 110 pb^{-1}
- signature: $2e + 2 \text{ jet}$
- Major backgrounds are top and Drell-Yan/Z

Selection Criteria	Observed Number of Events	Signal Efficiency (200 GeV)
2 electrons, $E_T > 25 \text{ GeV}$	7466	50%
2 jets, $E_{T1} > 30 \text{ GeV}, E_{T2} > 15 \text{ GeV}$	228	45%
$m_{ee} < 76 \text{ GeV or}$ $m_{ee} > 106 \text{ GeV}$	27	41%
$E_{Te1} + E_{Te2} > 70 \text{ GeV}$ $E_{Tj1} + E_{Tj2} > 70 \text{ GeV}$	12	40%
ej invariant mass cuts	3	28%
Expected Background	5.8 ± 2.2	—

- All final candidates have $m_{ej} < 140 \text{ GeV}$
- Signal efficiencies calculated with PYTHIA
 - ♦ ~21% for LQ_1 with mass $140 \text{ GeV}/c^2$
 - ♦ ~28% for LQ_1 with mass $240 \text{ GeV}/c^2$

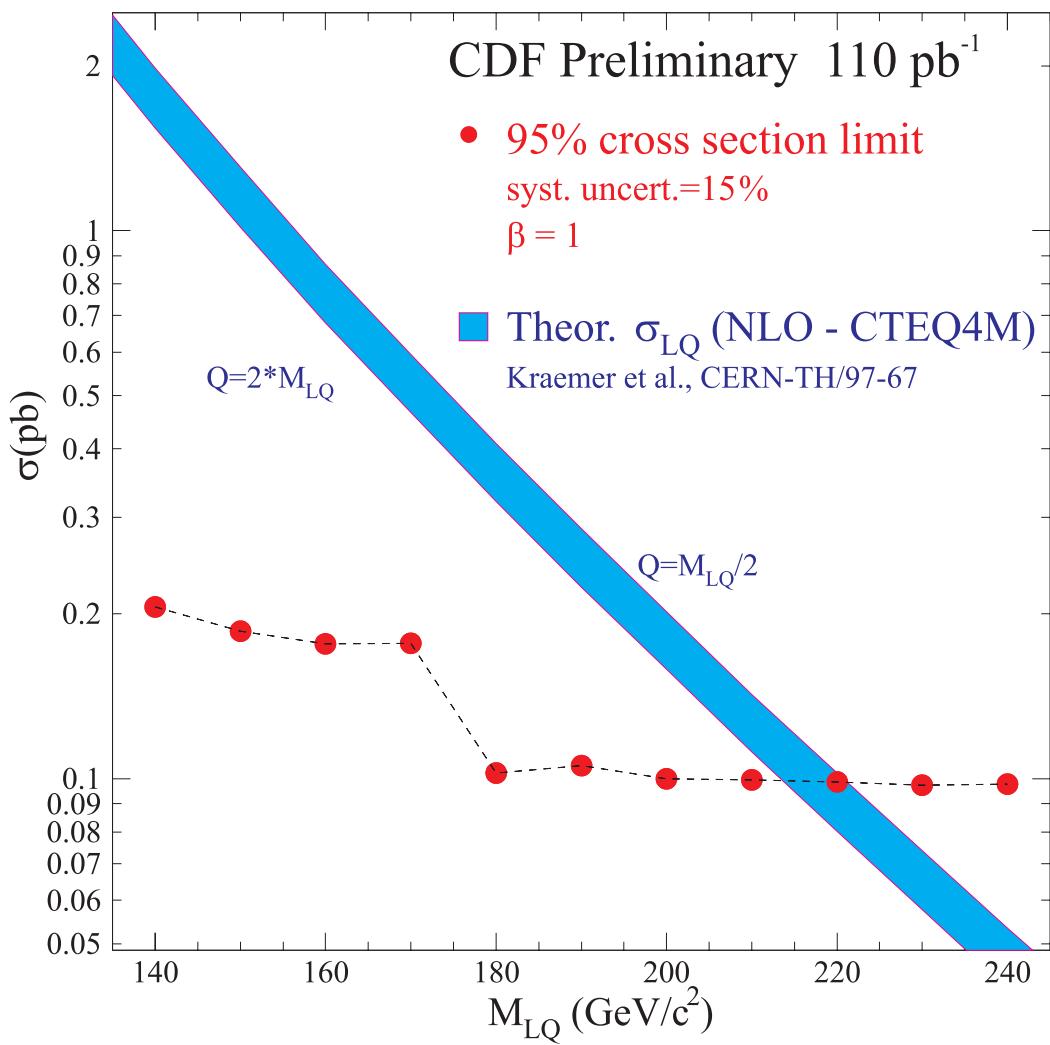
Electron-jet mass correlations

- CDF data vs. LQ₁ (200 GeV) Monte Carlo



LQ_1 Cross Section Limit: CDF

- 95% CL mass limit of 213 GeV for $\beta=1$
- for LQ_1 mass 180-240 GeV, limit is 0.1 pb



LQ_1 Search: $D\emptyset$ $eejj$ channel

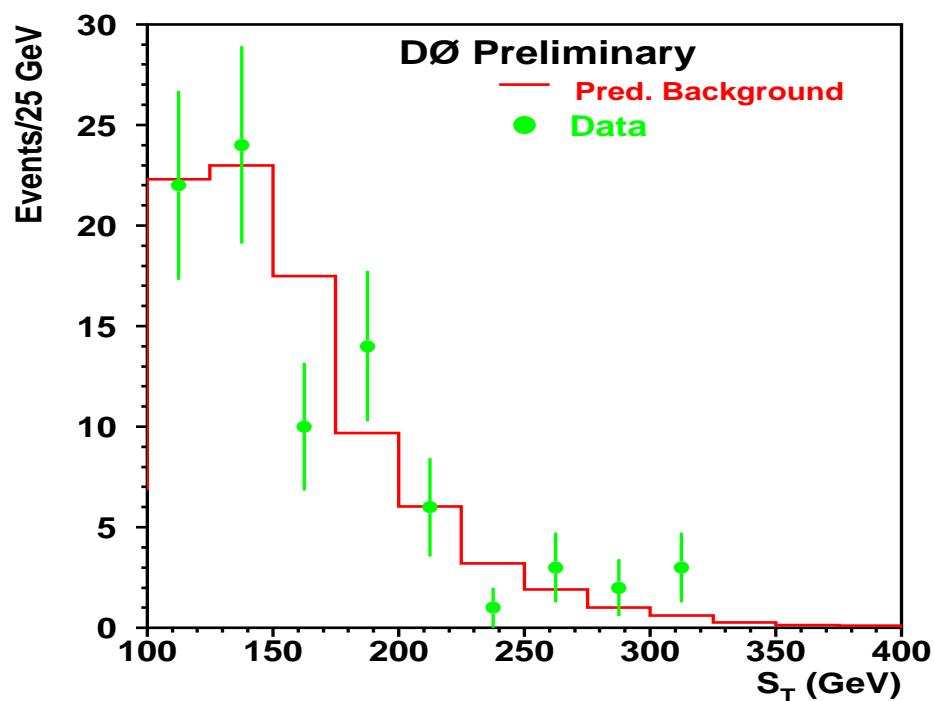
- Integrated luminosity: 123 pb^{-1}
- signal: $2e + 2 \text{ jet}$

Selection Criteria	Observed Number of Events	Signal Efficiency (200 GeV)
2 EM clusters, $E_T > 20 \text{ GeV}$ 2 jets, $E_T > 15 \text{ GeV}$	2918	67%
$\text{DR}(e - \text{jet}) > 0.7$	2496	56%
$m_{ee} < 82 \text{ GeV or}$ $m_{ee} > 100 \text{ GeV}$	1802	53%
at least one “tight” electron additional “loose” electron	101	40%

- Formal optimization technique used to determine final selection criteria
 - maximized expected signal, while constraining expected background to a fixed level (0.4 events)

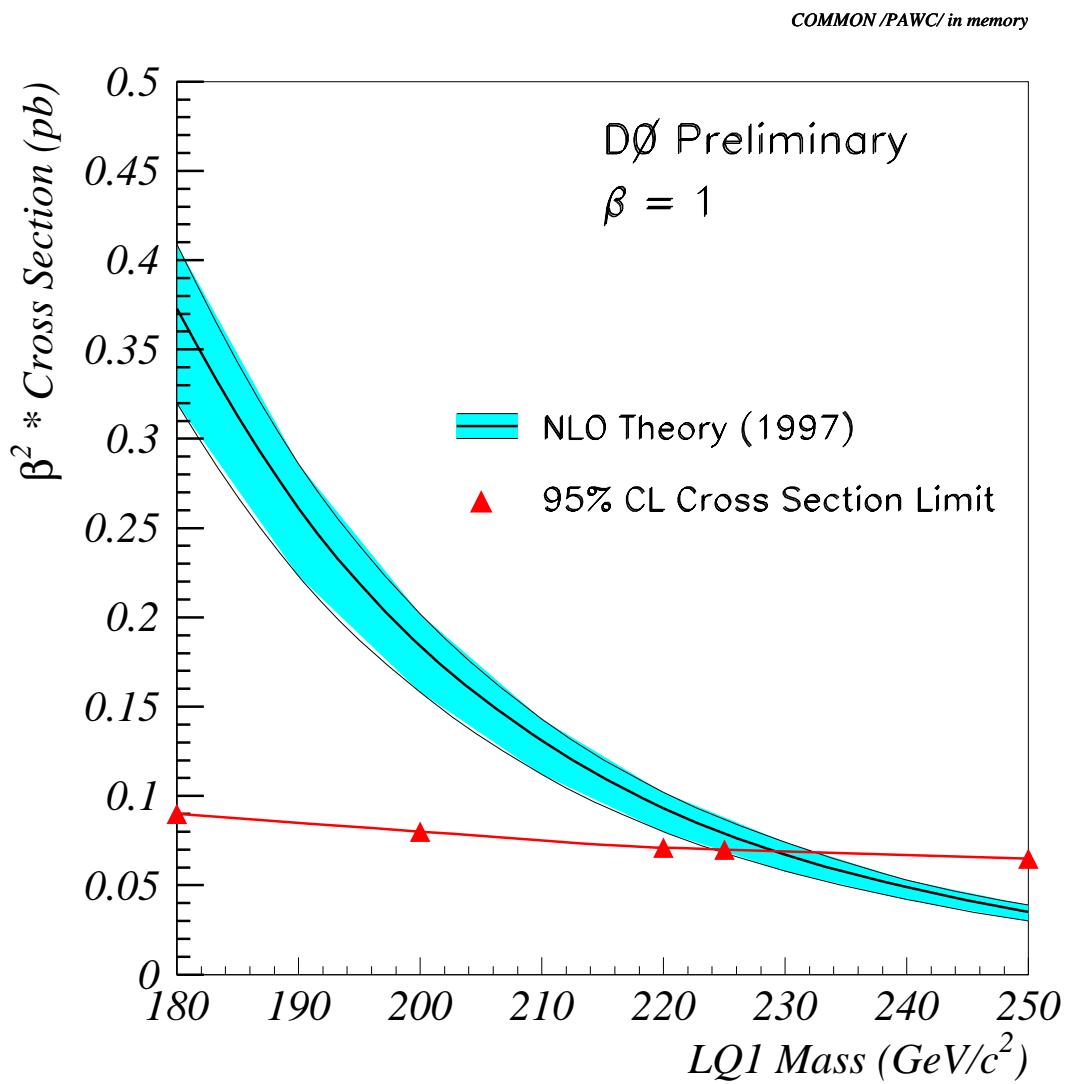
2 e + 2 jet optimization

- ~50 different combinations of variables tested in Random Grid search
- Single most effective variable was S_T
 - ♦ $E_{Te1} + E_{Te2} + \sum E_T$ (all jets with $E_T > 15$ GeV)
- Final selection $S_T > 350$ GeV
 - ♦ 0 events observed; 0.44 ± 0.06 expected from SM
 - ♦ final signal efficiency 16-36% for mass 160-250



LQ_1 Cross Section Limit: $D\emptyset$

- 95% CL mass limit of 225 GeV for $\beta=1$
- for LQ_1 mass 180-250 GeV, limit is 0.09 pb-0.07 pb

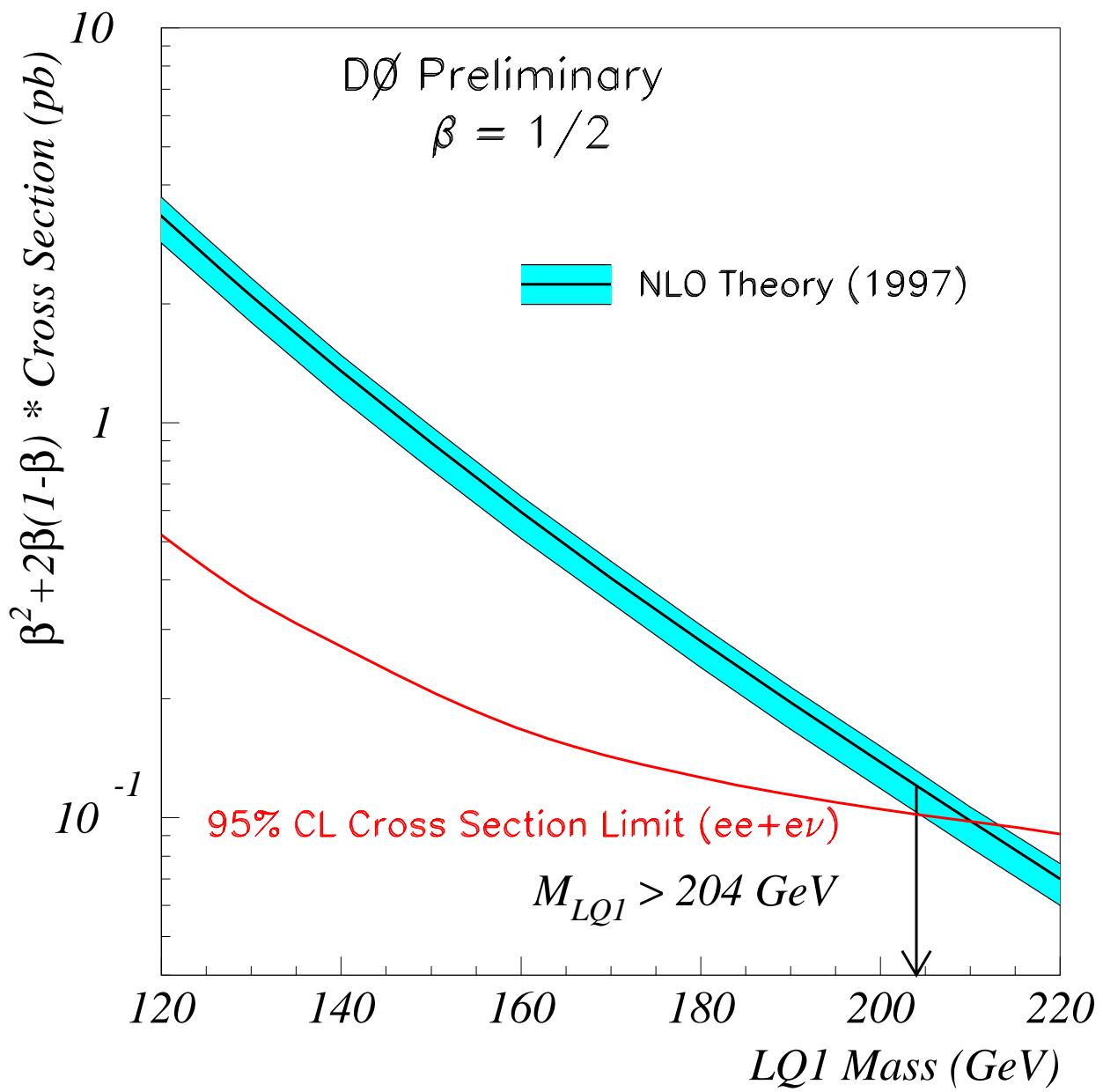


$e + \nu + 2 \text{ jet Channel}$

- For $\beta=0.5$, the $eejj$ channel is sensitive to only 25% of the LQ_1 cross section
 - ♦ 25% $eejj$
 - ♦ 25% $\nu\nu jj$
 - ♦ 50% $evjj$
- Both CDF and D \emptyset also use the $evjj$ channel to search for LQ_1 production
 - ♦ electron + missing transverse energy (ME_T) + 2 jets
 - ♦ Major backgrounds: $t\bar{t}$ and $W + 2$ jets
- CDF
 - ♦ single e , large ME_T , 2 jets, b -tag veto
 - ♦ transverse mass > 120 GeV
 - ♦ observe 2 events, predicted background 3.2 ± 0.8
- D \emptyset
 - ♦ single e , large ME_T , 2 jets, $ST > 170$ GeV, no isolated muons, mass window cut
 - ♦ observe 0 events, predicted background is ~ 0.4

First Generation Leptoquarks

eejj+ evjj search



$M_{LQ1} > 204 \text{ GeV/c}^2 \text{ for } \beta = 0.5$

Summary of LQ₁ Limits

- LQ1 mass limit for $\beta=1$ depends only on the eejj cross section limit
- LQ1 mass limit for $\beta=0.5$ depends on a combination of the *eejj* and *evjj* limits
- mass limits at 95% CL

$\beta=1$

- ♦ $m > 225$ GeV (DØ)
- ♦ $m > 213$ GeV (CDF)

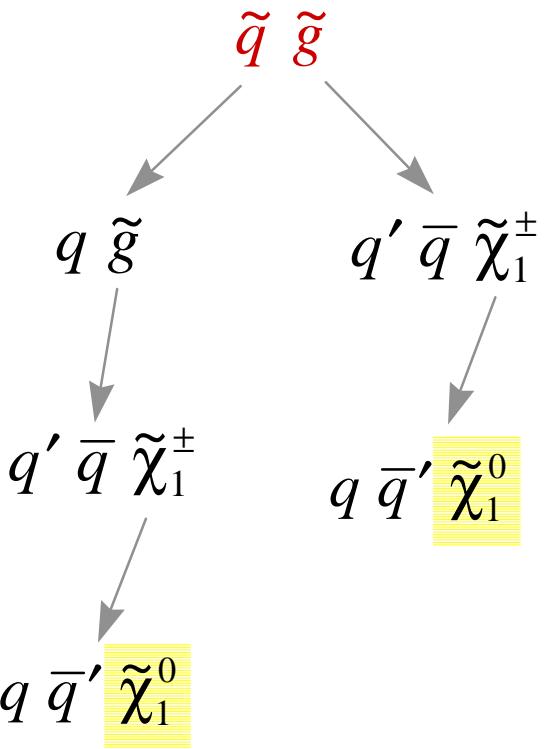
$\beta=0.5$

- ♦ $m > 204$ GeV (DØ, *eejj + evjj*)
- ♦ $m > 180$ GeV (CDF, *evjj*)

Jets + Missing E_T

- squarks and gluinos would be pair produced
 - ♦ decay involves many particles
 - ♦ final state dominated by quarks and LSPs
 - ♦ signature: jets + ME_T
- Many free parameters
 - ♦ use more constraining model: SUGRA
- Search for large ME_T and 3 or more jets
- SM backgrounds are large
 - ♦ top (!)
 - ♦ $W/Z + \text{jets}$
 - ♦ WW and WZ
- Instrumental backgrounds are difficult
 - ♦ huge QCD multijet cross section
 - ♦ missing E_T can be a result of mismeasured jets *or* misidentification of vertex

A “typical” SUSY event decay chain



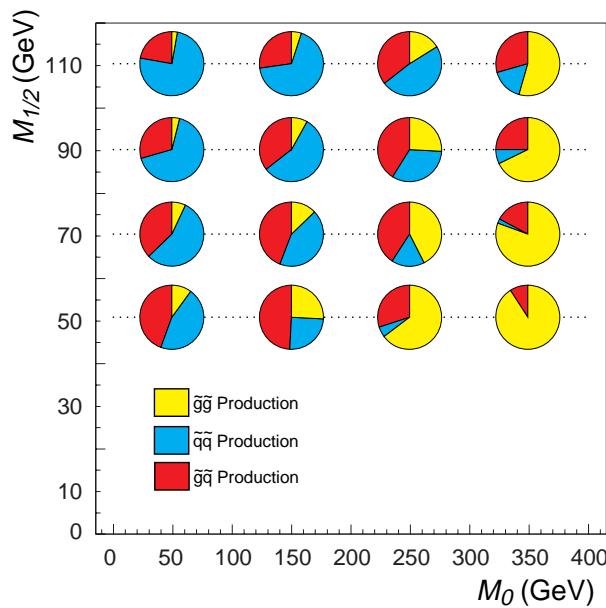
Jets + ME_T: DØ

- 79 pb⁻¹ integrated luminosity

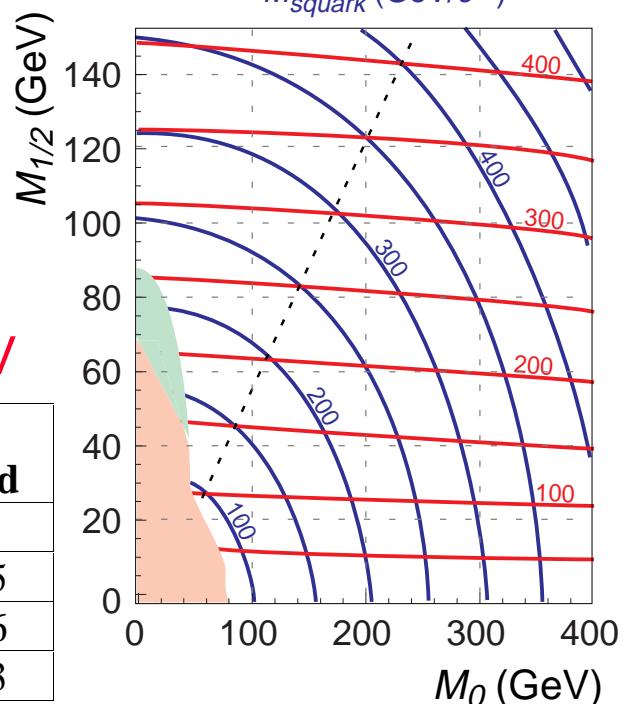
Selection Criteria	Observed Number of Events
ME _T > 40 GeV	
1 jet E _T > 115 GeV, 3 jets E _T > 25 GeV	2723
ME _T not aligned with/against jet	550
Σ (jet=2..N) E _T = H _{T2} > 100 GeV	431
ME _T > 75 GeV	50
no isolated muons	49
leading E _T jet confirms vertex	15
Expected Background	9.3 ± 3.5

- Final selection criteria optimized for different regions of SUGRA parameter space
 - ♦ H_{T2} cuts from 100 to 150 GeV
 - ♦ ME_T cuts from 75 to 100 GeV
- Signal efficiencies vary from 1-10%

$Jets + ME_T: D\emptyset$



Features of the SUGRA mass plane



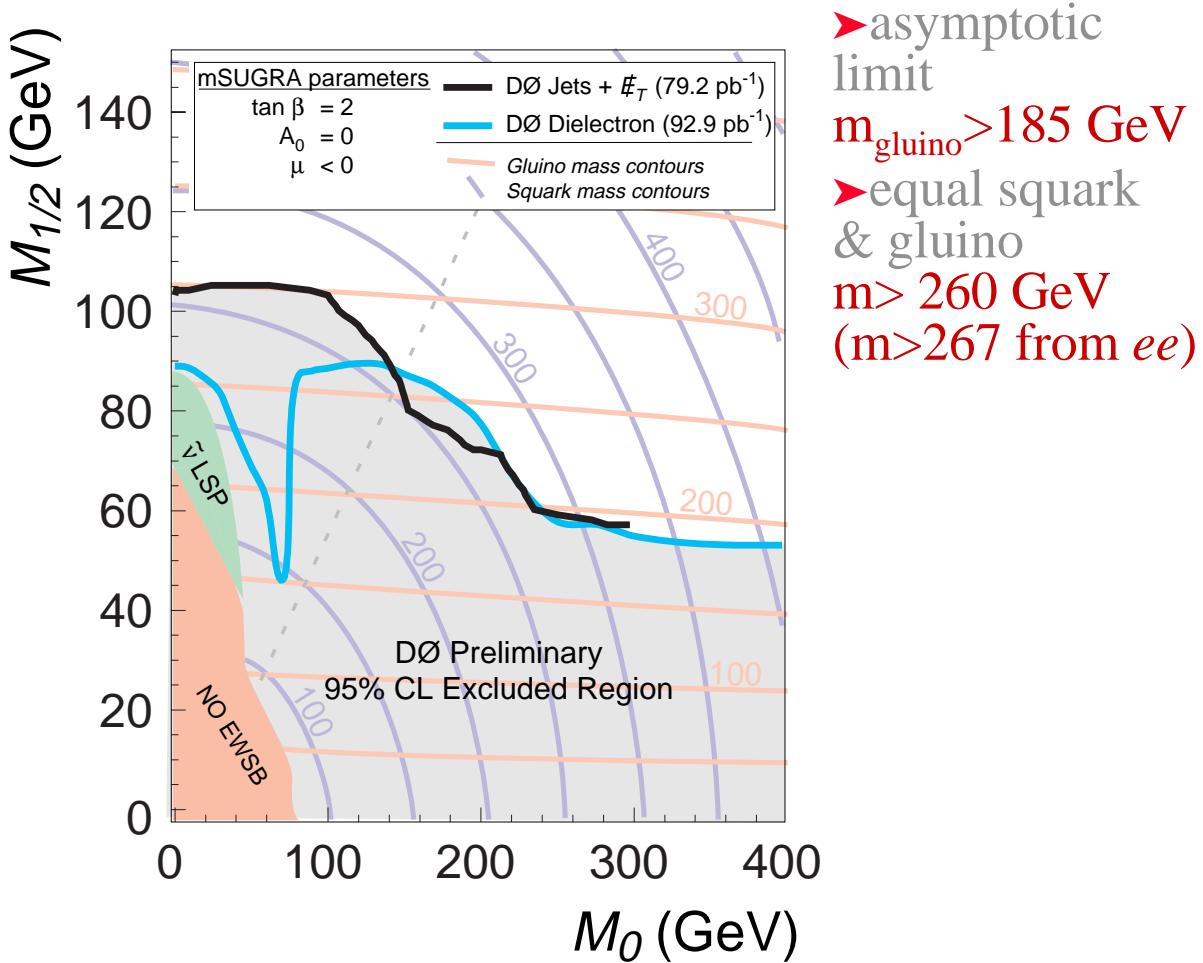
Events with $H_{T2} > 100$ GeV

ME_T Threshold	Events Observed	Events Predicted
50	49	44 ± 9
75	15	9.3 ± 3.5
90	8	7.0 ± 2.6
100	7	5.6 ± 2.3

SUGRA exclusion contour:

DØ

- 95%CL exclusion contour determined in $(m_0, m_{1/2})$ parameter space of minimal low energy supergravity (SUGRA)



CDF Summary

Searches	Current CDF limit (GeV/c ²) (mostly Preliminary) Excluded region at 95% C.L.	data set(pb^{-1})
$W' \rightarrow e\nu$ (SM)	< 652	1a (20)
$W' \rightarrow \mu\nu$ (SM)	< 646	1b (90)
$W' \rightarrow WZ$	< 560	1a+1b (110)
$Z' \rightarrow \ell\ell$ (SM)	< 690	1a+1b (110)
$Z_\psi, Z_\eta, Z_\chi, Z_I$	< 580, 610, 585, 555	1a+1b (110)
Z_{LR}, Z_{ALRM}	< 620, 590	1a+1b (110)
Axigluon \rightarrow dijet	$200 < M < 930$	1a+1b (103)
Technirho \rightarrow dijet	$250 < M < 500$	1a+1b (103)
topgluon , = .1M	$200 < M < 550$	1a (20)
topgluon , = .5M	$200 < M < 370$	1a (20)
Leptoquark(1st gen.)	< 213(scalar, $\beta = 1$)	1a+1b(110)
Leptoquark(2nd gen.)	< 195(scalar, $\beta = 1$)	1a+1b(110)
Leptoquark(3rd gen.)	< 99(scalar, $\beta = 1$)	1a+1b(110)
Leptoquark(3rd gen.)	< 170, 225(vector, $\kappa = 0, 1$)	1a+1b(110)
Pati-Salam LQ(B_s -e μ)	< 12100	1b (88)
Pati-Salam LQ(B_d -e μ)	< 18300	1b (88)
Composit, Scale (qqee)	< 3400(-), 2400(+)	1a+1b (110)
Composit, Scale (qq $\mu\mu$)	< 3500(-), 2900(+)	1a+1b (110)
$q^*(W+\text{jet}, \gamma+\text{jet})$	< 540	1a (20)
$q^* \rightarrow$ dijet	$200 < M < 750$	1a+1b (103)
charged stable ptl.	< 195(color tripl. q)	1b (90)
gluino(MSSM)	< 180(all \tilde{q} mass)	1b (80)
gluino(MSSM)	< 230($M_{\tilde{q}} = M_{\tilde{g}}$)	1b (80)
gaugino(MSSM)	< 68 ($\tilde{\chi}_1^\pm, \tilde{\chi}_2^0$)	1a+1b (110)
H^\pm	< 150 for $\tan\beta > 100$ or < 1	1a+1b (100)
$H^0(\bar{p}p \rightarrow WH^0, H^0 \rightarrow b\bar{b})$	$\sigma > 20pb$	1a+1b (110)

<http://www-cdf.fnal.gov/physics/exotic/exotic.html>

DØ Summary

Particle	Signature	DØ 95% confidence level limit
W_R	Resonance in $e E_T$ spectra 2 e's, 2 jets	$650 \text{ GeV}/c^2$ for $M(N_2) < \frac{1}{2}M(W_R)$
b'	2 γ 's and 2 jets 1 γ , 2 jets, b-tag	$M > M_Z + M_b$ $M > M_Z + M_b$
Higgs	$W \rightarrow e, \mu$ plus ν plus 2 jets with btag $W \rightarrow jj$ plus 2 γ 's	$\sigma < 50 \text{ pb}$ at $80 \text{ GeV}/c^2$ *, $\sigma < 19 \text{ pb}$ at $120 \text{ GeV}/c^2$ * $81 \text{ GeV}/c^2$ *
\tilde{q} 's	3 jets and \cancel{E}_T 2 e's, 2 jets, and \cancel{E}_T	$260 \text{ GeV}/c^2$ for $M(\tilde{q})=M(\tilde{g})$ * $267 \text{ GeV}/c^2$ for $M(\tilde{q})=M(\tilde{g})$ *
\tilde{g} 's	4 jets and \cancel{E}_T 2 e's, 2 jets, and \cancel{E}_T	$173 \text{ GeV}/c^2$ $185 \text{ GeV}/c^2$ *
\tilde{W}, \tilde{Z}	tri-leptons 2 γ 's and \cancel{E}_T	$\sigma < 66 \text{ fb}$ for $M(\tilde{W}_1)=45 \text{ GeV}/c^2$, $\sigma < 100 \text{ fb}$ for $M(\tilde{W}_1)=124 \text{ GeV}/c^2$ $M(\tilde{W}_1)>156 \text{ GeV}/c^2$ *
\tilde{e} or $\tilde{\nu}$	2 γ 's and \cancel{E}_T	$\sigma < 200 \text{ fb}$ for $M(\tilde{W}_1)-M(\tilde{Z}_1)>30 \text{ GeV}/c^2$ *
Z'	di-jets di-electrons	$M < 365 \text{ GeV}/c^2, M > 615 \text{ GeV}/c^2$ * $M>670 \text{ GeV}/c^2$ *
W'	di-jets e ν	$M < 340 \text{ GeV}/c^2, M > 680 \text{ GeV}/c^2$ * $M > 720 \text{ GeV}/c^2$
q^*	di-jets	$M > 725 \text{ GeV}/c^2$ *
LQ1	ee jet jet e ν jet jet $\nu\nu$ jet jet	$M > 225 \text{ GeV}/c^2, \beta = 1$ * $M > 192 \text{ GeV}/c^2, \beta = 0.5$ * $M > 80 \text{ GeV}/c^2 \beta = 0.$ *
LQ2	$\mu\mu$ jet jet $\mu\nu$ jet jet $\nu\nu$ jet jet	$M > 184 \text{ GeV}/c^2, \beta = 1$ * $M > 140 \text{ GeV}/c^2, \beta = 0.5$ * $M > 80 \text{ GeV}/c^2 \beta = 0.$ *
LQ3	bb $\nu\nu$	$M > 93 \text{ GeV}/c^2$ *
t	acolinear di-jets	$M > 93 \text{ GeV}/c^2$ for $M(\tilde{Z}_1) < 8 \text{ GeV}/c^2$

* → PRELIMINARY RESULT

[http://www-d0.fnal.gov/www_buffer/
new_phenomena/new_phenomena.html](http://www-d0.fnal.gov/www_buffer/new_phenomena/new_phenomena.html)

Searches: Present and Future

- The current Tevatron data sample (200 pb^{-1} , shared between CDF and DØ) is the one of most promising current resources for new particle searches
- Both collaborations will continue to exploit their data until the start of Run II of the Tevatron, in 1999
- Running at 2 TeV (12% higher energy), and delivering 2 fb^{-1} to each detector before 2002, the Tevatron will provide to CDF and DØ the excellent opportunities for new discoveries
- Fermilab is proposing a Run III, with a goal of 30 fb^{-1} for each detector by 2006, by which time the LHC is expected to be fully operational

Standard Model

M_{top} vs. M_W

